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UPPER MISSOURI RIVER

RESERVOIR OPERATING GUIDELINES FOR FISH, WILDLIFE AND RECREATION

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Montana Department of Fish, Wildlife and Parks

Revised
April 1985

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BACKGROUND

The Missouri River from Toston to Great Falls offers a remarkable variety of fishing, hunting, boating, and other recreational opportunities. This reach contains three major reservoirs and over 100 miles of free-flowing river. Its importance as a fishery resource is clearly evident; one of every seven angler days occurs on this reach. Other recreational attributes are also important.

The three reservoirs in this area are Canyon Ferry, Hauser, and Holter. Canyon Ferry, the uppermost of the three reservoirs, is a large storage reservoir operated by the Bureau of Reclamation. It controls seasonal flow patterns downstream. Hauser and Holter Dams are run-of-river reservoirs operated by Montana Power Company. They can influence daily flows but are too small to influence seasonal flow patterns. The operation of the reservoirs can have a significant impact on the fishery, wildlife, and recreational resources in this reach of the Missouri River. This document is intended to identify reservoir water levels and flow release patterns which optimize these recreational values and minimize impacts on fish and wildlife in each area.

SUMMARY

Canyon Ferry Reservoir

Canyon Ferry Reservoir is a large storage reservoir upstream from Hauser and Holter reservoirs. Since both Hauser and Holter are run-of-river reservoirs, the releases from Canyon Ferry generally determine the flow patterns in downstream reaches.

Fisheries, wildlife and recreational values are affected by the seasonal pattern of reservoir water level fluctuations. Recommended reservoir operations to protect these resource values are summarized below.

Fisheries

There is strong evidence that excessive spills through the radial spillway gates may result in a significant loss of fish from Canyon Ferry Reservoir. Because of this, it is recommended that, whenever possible, spills through the radial spillway gates be restricted to the normal high flow period and, limited to a duration of 30 days and a maximum discharge of 4000 ft^3/s.

Desirable reservoir elevations during spring and fall are between 3,785 and 3,792 ft. elevation. Reservoir elevations during winter should be stable to moderately receding.

Wildlife

Reservoir elevations affect the wildlife management area waterfowl ponds at the upper end of the reservoir. Water elevations above 3,797.5 should be avoided. Fall reservoir elevations should be between 3,788 ft and 3,792 ft. Winter reservoir elevations between 3,782 ft and 3,786 ft are recommended.

Recreation

Reservoir levels for recreation during summer months (May 21-Sept. 30) can range from 3,790 ft to 3,798 ft. Optimum is near 3,795 ft. Desirable winter elevation for developed recreation areas and other developed shorelines is 3,786 ft and ranges from 3,782 ft to 3,790 ft.

It should be noted that reservoir levels for recreation are based on whether or not physical facilities and structures at recreation sites are functional. Most recreation sites are designed to accommodate a range of water levels. Generally, recreation sites can accommodate a wider range of fluctuations than other resource values.

Hauser Reservoir

Hauser is operated as a run-of-river reservoir and therefore this area experiences a fairly constant water elevation. Development along the lake shore has occurred and is dependent upon this relatively constant water level. Fluctuations in Hauser Reservoir could have a significant impact upon many developments surrounding the lake due to the shallow nature of the developed shorelines and the open connection with Lake Helena.

It is recommended that Hauser Reservoir be operated with a stable reservoir level at elevation 3,635.2 ft. ± 0.5 ft. There should be no daily reservoir level fluctuations during the winter period. Drawdowns of Hauser Peservoir associated with repair or maintenance should be accomplished during the non-holiday periods in August and September.

Missouri River Below Hauser

Fall and winter flows in the Missouri River below Hauser Dam should be stable at 4,100 CFS. This would insure adequate conditions for trout and salmon spawning, incubation, and hatching.

If hydropower or dam maintenance requires partial dewatering of the Hauser tailrace area, it should be done from late July through September 15 during non-holiday periods.

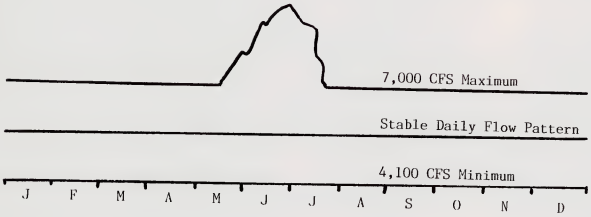
Holter Reservoir

Holter is operated as a run-of-river reservoir and therefore this area experiences a fairly constant water level. It is recommended that Holter be operated in a stable manner at the normal operating elevation of 3,578 ft. Variations in reservoir elevation should not exceed 0.5 ft above or 1.0 ft below elevation 3,578 ft.

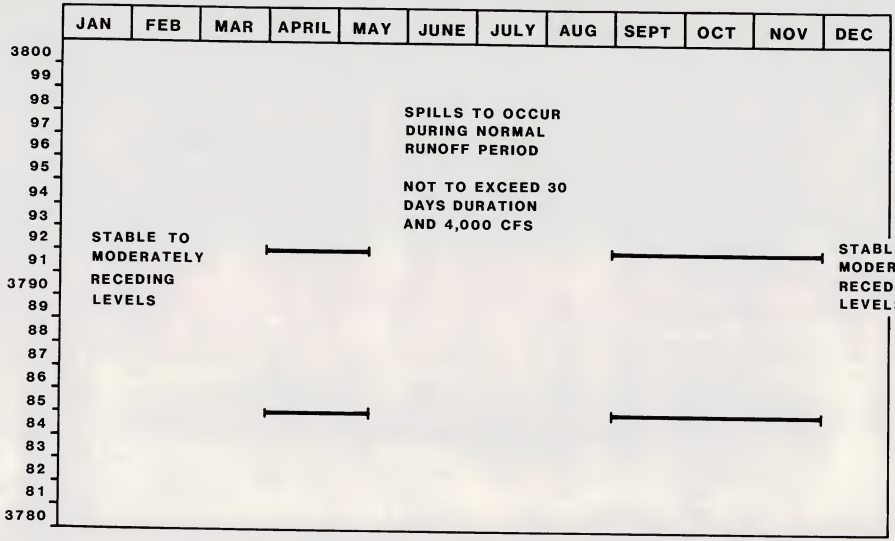
If hydropower structure maintenance calls for drawdown on Holter Lake, it should be done in April or September during non-holiday periods. Flows should not be altered beyond recommended limits in the Missouri River below Holter to accommodate evacuation or refilling of the reservoir. Spills in the magnitude of 10,000 CFS (total turbine and spill) should not occur in August or September. These spills cause serious loss of newly stocked fish in the reservoir.

Missouri River Below Holter

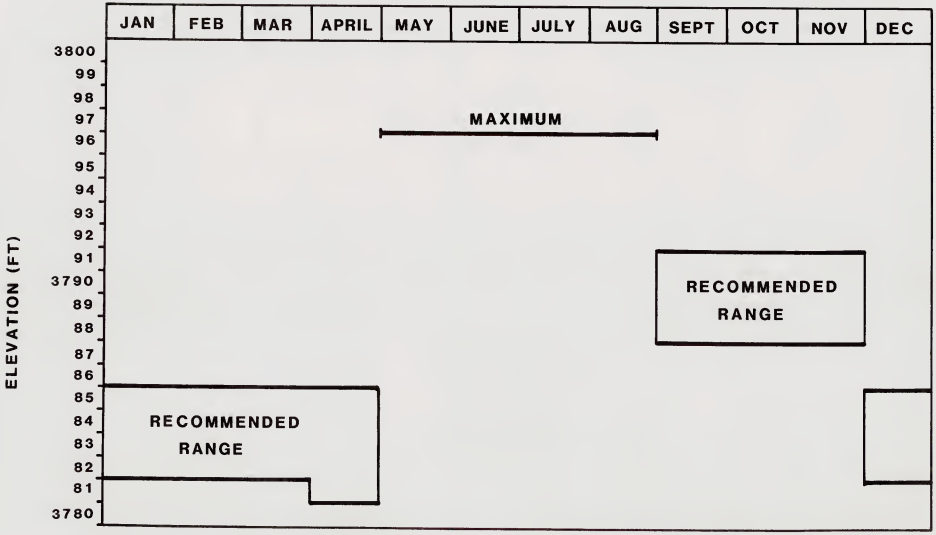
Holter Dam should be operated as a run-of-river hydropower facility with stable daily flow releases. The minimum release from Holter should be 4,100 CFS year round. After spring runoff subsides flows should not be greater than 7,000 CFS.



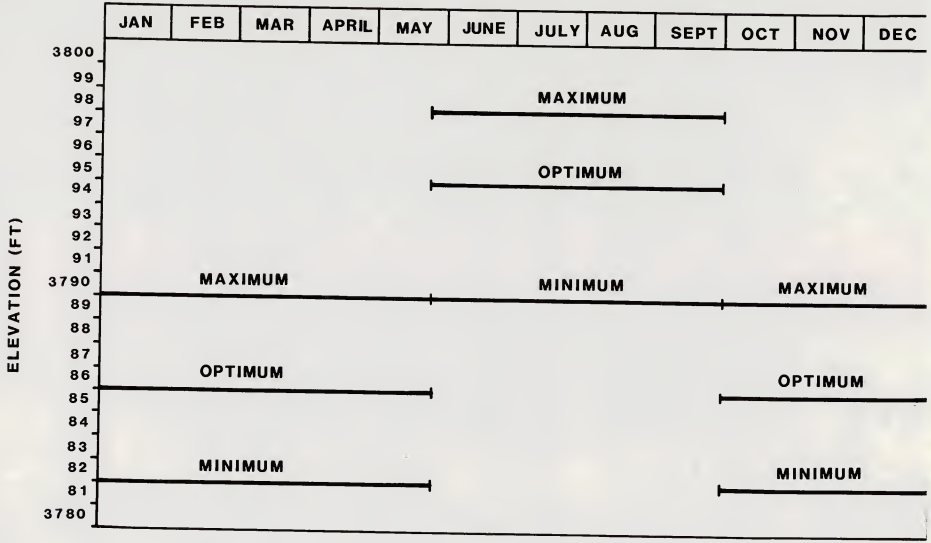
FISHERIES - Canyon Ferry Reservoir Levels



WILDLIFE-Canyon Ferry Reservoir Levels



RECREATION-Canyon Ferry Reservoir Levels



SUPPORTING STATEMENTS

Missouri River--Toston to Canyon Ferry

The Missouri River from Toston to Townsend contains good resident fish populations and supports a substantial fishery. In addition, the river below Toston Dam provides spawning areas for fish populations residing in Canyon Ferry Reservoir. A rainbow trout spawning run enters this reach in the spring and fall of most years. A major brown trout spawning run occurs every year, and fish usually concentrate in large numbers below Toston Dam. These fish are very large and provide an important and popular trophy brown trout fishery.

This 20-mile reach is popular for floating in the summer months, offering an all day float if the entire reach is floated, or a half day float by utilizing the Deep Dale Fishing Access Site. Waterfowl hunting is popular in the fall throughout the entire reach. The islands and riparian zones also offer hunting opportunities for deer and pheasant during the fall season.

An important aspect of providing recreational opportunities in this reach is the maintenance of adequate instream flows. The Montana Department of Fish, Wildlife, and Parks (MDFWP), under provisions of 1969 legislation (Sec. 89-801, RCM, 1947) filed for an instream flow right for this reach of 3,000 CFS. The Department has reclaimed this right under the statewide adjudication process, and the claim is currently under review by the water courts.

As stated previously, flows and water levels in the Missouri River from Toston Dam to the Townsend Bridge are not affected by the operation of Canyon Ferry Reservoir. However, because this reach provides spawning grounds for Canyon Ferry fish, reservoir operations which tend to diminish reservoir fish populations would lead to depressed spawning runs. This, in turn, would reduce angling opportunities from Toston Dam downstream.

Canyon Ferry Reservoir

Fisheries

Canyon Ferry Reservoir is one of the most heavily-fished bodies of water in the state. In 1983, for example, 118,000 fisherman days were spent on this reservoir. The most sought-after sport fish include rainbow and brown trout and yellow perch. Trolling and bank fishing occupy the summer months while winter ice fishing is experiencing increasing popularity.

The bulk of the reservoir rainbow trout population is supported by annual plants of hatchery subcatchables. The reservoir brown trout population is sustained through natural recruitment. Under proper conditions, excellent populations of rainbow trout can develop in the reservoir and provide exceptional angling opportunities. Good reservoir trout populations not only provide angling opportunities in the reservoir, but also enhance the fishery in the Missouri River upstream from Canyon Ferry during the spring and fall spawning runs. During those years when rainbow trout populations are low in Canyon Ferry, rainbow spawning runs in the Missouri are noticeably less, and angling opportunities considerably reduced.

There are three aspects of reservoir management which can potentially affect the fishery in Canyon Ferry. First and probably most important, are the magnitude and duration of the spill as related to fish escapement. Second is the reservoir level in the spring and fall and its influence on the use by fishermen of the delta area. Third is the effect of winter reservoir operation on ice conditions and, subsequently, the ice fishery.

1. Spill conditions and fish escapement. The rainbow trout fishery in Canyon Ferry is supported almost entirely with hatchery fish planted as subcatchables (4-6 inches long). The strain of fish stocked is fast growing, but fairly short lived. Annual plants are necessary to sustain this fishery.

   Escapement of stocked fish from the three reservoirs has been identified as a problem as far back as the mid 1960's. As a result, stocking policies have changed over the years, and current practice is to stock subcatchables after the normally occurring high flow period.

   Even with stocking after high water, problems have been noted in various years with unsuccessful plants and low year class strengths in subsequent years. The problem was highlighted in 1982 and 1983 when the rainbow population was at a very low level. A more intensive study of fish escapement from Canyon Ferry was

initiated at that time. Initial findings of this study indicate that:

a) the fish most susceptible to escapement from Canyon Ferry Reservoir are the newly stocked subcatchable rainbow trout. Adult escapement is, at the present time, considered to be of minor importance,

b) the magnitude and duration of the spill has an important effect on escapement. Spills of less than 4,000 CFS and 25 days duration have little effect on escapement. Spills greater than 4,000 CFS and 30 days duration produce moderate to severe levels of escapement, and

c) late summer spills after the normal stocking period can produce high levels of escapement. The spill conditions during late August and September produced an estimated 30% level of escapement.

Recommendation: Spills should only occur during the normal high-flow period. Spills should be less than 30-days duration and 4,000 CFS.

2. Missouri River Delta Area. The delta area at the head end of Canyon Ferry Reservoir is a popular and productive area to fish during the spring and fall. High reservoir levels limit access to the islands and gravel bars in the delta area and make fishing difficult.

Recommendation: During the spring (April-Mid May) and fall, (September-November) desirable reservoir elevations to maintain fishability of the delta area are between 3,785 and 3,792 ft.

3. Winter Ice Conditions. There is very popular ice fishery on Canyon Ferry Reservoir for rainbow and brown trout and yellow perch. This fishery is dependent on safe, relatively stable ice conditions.

Recommendation: Stable or moderately receding reservoir levels are desired. Sudden reservoir level drops or rises should be avoided since both situations contribute to unstable or dangerous shoreline ice conditions.

Wildlife

Description of Resource

The Canyon Ferry Wildlife Management Area is located on the south end of Canyon Ferry Reservoir approximately 1 mile north of Townsend. The area has been administered by the MDFWP under a

contractual agreement with the Bureau of Reclamation since the mid-1950's. Intensive development associated with the dust abatement program began in 1973, and major construction of the dike system was completed in 1978.

The dike system includes four subimpoundments (ponds) and approximately 11 miles of dike. Approximately 300 plus nesting islands have been constructed within the ponds. The ponds vary in size from 400 to 500 acres and total about 1,800 surface acres when combined. There are two diversion headgates on the Missouri River. Water control structures at these points control flows into the eastside and westside canals which deliver water to the pond system.

Approximately 5,000 acres of riparian and upland habitat are included within the management area. This also contains about 1.5 miles of river bottom and extends into the delta area. A total of 1,100 acres is managed under agricultural leases to adjacent landowners. The basic format is a barley-alfalfa hay crop rotation. Some livestock grazing also occurs.

The remainder of the reservoir has some well developed riparian areas associated with the lower end of the larger tributary streams (Duck, Confederate, and Avalanche creeks). Riparian zones are developing along the east shore and have been enhanced by the elimination of livestock grazing in these areas. The reservoir also provides important loafing areas for spring and fall migrant waterfowl. Nesting by Canada Geese along the main reservoir is occurring, but secure nest sites are limited.

Status of Associated Wildlife Populations

The most dramatic increase in local waterfowl population units has been that documented with the resident flock of Canada Geese. The number of active nesting pairs increased from less than 50 pairs in 1974 to 223 in 1983. The majority of this increase has been associated with the islands within the pond system. The number of nests observed on the river islands has declined during this period which is an indication of the attractiveness of the pond system to nesting geese. This trend on the river will probably begin to reverse itself once the density of nests on the ponds becomes saturated.

Quantified data from 1982-1984 indicate an increase in the duck nesting effort on the pond system. Forty duck nests, most of which were mallards, were recorded during the 1984 field season. The response by ducks has been limited by their more restrictive nest site requirements. In fact, ducks may represent a more sensitive barometer to the ecological changes that are occurring on the project. The main key to these changes is the stabilization of water levels and the corresponding establishment of the different vegetation zones.

Many other species (shorebirds, gulls, cormorants, and pelicans) have established seasonal use patterns on this system. Use by both breeding and nonbreeding components of these groups is increasing.

Waterfowl hunting accounted for the following use during the opening weekend period in 1984. An estimate of 233 hunters harvested approximately 300 ducks and 107 geese. These estimates are based on hunter bag checks and contacts made during the Saturday-Sunday period.

Upland species that receive management emphasis are ring-necked pheasants and white-tailed deer. Trend information is collected annually for both, and pheasant numbers appear stable (with potential for increase) while whitetails are continuing to increase.

Check station work during the 1984 opening weekend of the pheasant season resulted in the following information. Approximately 103 pheasants were harvested by an estimated 258 hunters.

Furbearers are common on the management area. Trapping is restricted to permits only and the project has been divided into five trapping units. Trappers must apply for a permit and, if successful, must trap in a designated unit.

Chronology of Waterfowl Breeding Biology

Geese begin returning to the area any time from mid-February on, with specific arrival dates dependent upon weather conditions. Mallard, pintail, goose, and swan numbers generally peak at the end of March through the first week in April. Numbers of birds typically observed during this period include 50,000 to 60,000 ducks, 1,000 geese, and 1,000 swans.

Geese begin selecting island nesting sites and initiating nests during April, and the broods begin coming off by mid-May. Most duck nesting occurs during late April, May, and June.

Molt migrant geese leave the area by the first part of June and move up into the NW Territories. Breeding birds and their young are usually flightless into mid-July. Late summer staging by ducks begins to occur in August, and goose numbers generally peak in mid to late September. Prior to the 1984 hunting season (September 29th) an estimated 2,500 geese and 5,000 ducks were present on the project. Duck and goose numbers generally decrease until freeze-up of the ponds occurs in mid-November and the reservoir in December.

Critical Aspects of Water Level Management (Seasonal)

Spring. Adequate water levels are imperative at this time (April) to insure that islands are attractive to nesting birds

and that the islands provide security from nest predators. In the pond system, water elevations in the range of 3,796 ft to 3,796.5 ft are desirable. Pool elevation in the reservoir during the spring period ranges typically from 3,781 ft to 3,786 ft with river flows in the 5,000 CFS category. This generally provides adequate security for river island nesting geese. During this period the water is restricted to the channels, and the river flows would be the critical factor.

Late Spring-Early Summer. Objective is to avoid pond elevations that would flood nests, and the same applies to the river system. Elevations in excess of 3,797.5 ft in the ponds are detrimental to island stability (wave action will cause severe erosion), nest success, and vegetation establishment. The distribution of the emergent vegetation zone on the ponds is quite limited, and during the period of establishment, these stands of cattail and bulrush are quite susceptible to high water.

Peak runoff and maximum storage in the reservoir impact the physical condition of the dikes. Pool elevations in excess of 3,797+ will also force seepage into the ponds, causing the pond elevation to rise above optimum conditions.

Summer. Late summer reservoir elevations (mid-July to mid-August) are critical to water elevation management in the pond system. If the reservoir pool elevation exceeds 3,797 ft during July and August, the pond elevations cannot be drawn to desired levels. This results in excessive water depths and reduces the productivity of the submergent vegetation at a time when the plants would normally be adapted to a drawdown.

Minimum flows would be required to insure that river water could be diverted into the canal system. This has not been a problem for the last 5 years.

Fall. Fall reservoir pool elevations should provide adequate gravel bars in the delta area in order to provide loafing areas for ducks and geese. These elevations would also maintain some exposed shoreline along the remainder of the reservoir with the same objective in mind. Once the birds have been hunted on the ponds, they switch to the lake. In order to hold the birds on the reservoir and in the area, these loafing sites are critical. An estimated range of reservoir elevations that would accomplish this would be 3,788 ft to 3,792 ft.

Winter. A drawdown of the reservoir during the winter period is part of the routine operation plan. Because of seepage and the fact that the canal system is typically shut down, the ponds experience a general overwinter drawdown. The extent of this drawdown is dependent upon the gradient between the ponds and the lake.

Freeze-up of the reservoir at an unusually high elevation (3,797 ft Fall/1983) could magnify the potential for ice jams on the

river just above the lake. If large chunks of ice are retained on the interior portions of the river islands, goose nesting is negatively impacted.

Optimum winter elevations would be in the 3,782-3,786 ft range.

Recreation

Canyon Ferry Reservoir is one of the most heavily utilized recreation areas in the state. It is the first major storage reservoir on the Missouri River and experiences large seasonal fluctuations in water levels. Winter drawdown levels may be anywhere from 3 to 14 ft below summer elevations. Various elements of the recreational resource at Canyon Ferry are influenced by reservoir water elevations. To assess the impact of various reservoir elevations on recreation opportunities, seven resource types were evaluated. These are as follows:

-Boat ramps
-Powerboating, waterskiing, sailing
-Camping-overnight use
-Picnicking-day use
-Swimming & scuba diving
-Cabin sites & residences
-Winter use; snowmobiling skating & cross-country skiing

Each use was evaluated with respect to the effect of various reservoir elevations on that use and recommendations developed which define an optimum and range of elevations. These are discussed below.

Boat ramps. There are seven boat ramps currently in existence. These are developed on 8-9% grades and are located at: Yacht Basin Marina, Kim's Marina, Hellgate Campground, Goose Bay Marina, Silos Campground (2 ramps), and White Earth Campground.

1983 boating use on Canyon Ferry was estimated at 71,660 visitor hours. An estimated 45,000 vehicles came into the area with boats.

Effect of water levels: Water levels that are unusually high or low will cause problems with the boat ramps. High water will give the recreationist trouble when trying to load and unload boats. Low water levels may cause the ramp to be above the water level, making it unusable.

Optimum water level: The desirable range of summer reservoir elevations is 3,790 ft-3,798 ft. The optimum summer elevation is 3,794 ft.

Power boating, waterskiing and sailing. Open lake available consists of 35,181 acres. There are two boat-access-only areas maintained.

1983 boating use on Canyon Ferry was estimated at 71,660 visitor hours. Breakdown:

Motorboat cruising or fishing	53%
Sailing	20%
Raft or Canoe	4%
Waterskiing	23%
Total	100%

Effect of water levels: High water levels tend to cause a problem with floating debris in the lake. Low water levels cause the exposure of rocks and sandbars that pose a potential hazard to boaters, especially those in motorboats or waterskiers. These become hazardous at approximately 3,792 ft.

Optimum water level: The desirable range of summer reservoir elevations is 3,791 ft-3,798 ft. The optimum summer elevation is 3,795 ft.

Camping-overnight use. There are 12 developed campgrounds with approximately 620 individual units. They are located at Court Sheriff, Ponderosa, Chinaman's Cave Bay, Jo Bonner, Hellgate, Goose Bay, Silos, White Earth, Overlook, Fish Hawk, and Shannon.

Total visitation in the study area in 1983 was 428,000.

Effect of water levels: High water levels will cause flooding of major camping areas. Low water levels will have no significant effect although there are indirect effects to be considered. Most campers are in the area for other purposes in conjunction with camping. If the other activities are affected, the camping activity is also.

Optimum water levels: The desirable range of summer reservoir elevations is 3,790 ft-3,797 ft. The optimum summer elevation is 3,795 ft.

Picnicking-day use. A total of 16 day use sites are currently in existence, with 4 day use only areas. These include Lorelei, Lewis and Clark, Orchard, and Crittendon. Twelve sites are included as developments within camping areas.

Available for day use are 76 miles of shoreline and 1 mile of streambed acreage.

Visitor hours spent picnicking in 1983 totaled 153,247. Visitation on the West Shore in 1983 was 57,700, and total visitation in the study area was 428,000.

Effect of water levels: High water levels may cause flooding of these areas. Low water levels create a larger proportion of beach area.

Optimum water levels: Desirable range of summer reservoir elevations is 2,790 ft-3,796.5 ft. The optimum summer elevation is 3,794 ft.

Swimming and scuba diving. There are nine currently designated swimming areas located at Court Sheriff, Ponderosa, Chinaman's, Kim's Marina, Hellgate, Crittendon, Orchard, Lewis and Clark, and Lorelei.

The visitor hours spent swimming in 1983 were 76,624. Total visitation in the study area in 1983 was 428,000.

Effect of water levels: Low water levels create a larger beach area and may cause hazardous diving conditions. High water will often eliminate beaches and flood the surrounding landscape.

Optimum water levels: The desirable range of summer reservoir elevations is 3,791 ft-3,797.5 ft and the optimum summer elevation is 3,795 ft.

Cabin sites and residences. There are 265 cabin sites surrounding the reservoir with 167 located on the East Shore and 98 located on the West Shore. These sites receive heavy weekend use. Some are summer homes while others are designed as permanent residences.

Effect of water levels: High water levels may cause flooding, septic problems, and dock movement. Low water levels create problems as some water supplies are being taken directly from the lake. These levels also have an effect on the docks.

Optimum water levels: The desirable range of summer reservoir elevations is 3,791 ft-3,797 ft. The optimum summer elevation is 3,795 ft.

Winter use-snowmobiling, skating, cross-country skiing. When frozen, 35,181 acres are available for use on the lake itself, with 76 miles of shoreline access and surrounding area.

Winter use figures were unavailable.

Effects of water levels: High levels may cause problems with docking facilities. Low water levels are desirable in the winter to allow docks to winter on dry land. Low water levels cause no real problems for recreation during this time although some steep banks may become inaccessible. Rapid fluctuations will cause problems due to the weakening of the ice.

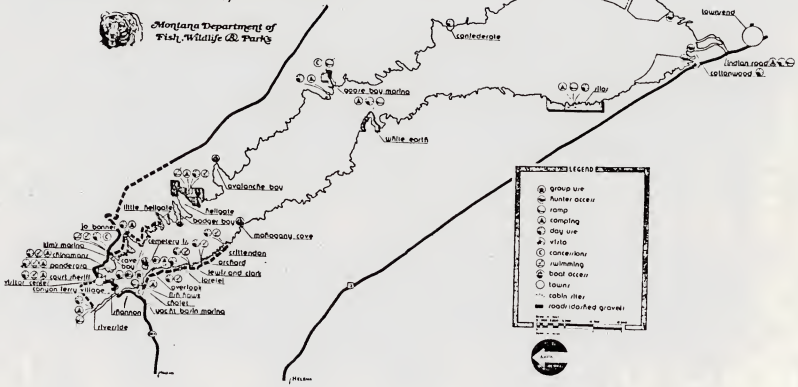
Optimum water levels: The desirable range of winter reservoir elevations is 3,782 ft-3,790 ft. Optimum winter elevation is 3,786 ft.

Summary of optimum water levels for all resource types at Canyon Ferry. The desirable range of all summer elevations is 3,790-3,798 ft. The optimum summer elevation (May 21 to Sept. 31) is 3,795 ft. The desirable range of all winter elevations is 3,782-3,790 ft, and the optimum winter elevation is 3,786 ft.

CANYON FERRY STATE RECREATION AREA

EXISTING RECREATIONAL FACILITIES

administered by



Hauser Reservoir

Fisheries

Hauser Dam impounds the Missouri River nearly to the base of Canyon Ferry Dam. Hauser Reservoir is 15.5 miles in length, has a surface area of 3,800 acres with a storage capacity of about 98,000 acre feet.

Common fish species in the reservoir are rainbow trout, brown trout, kokanee salmon, yellow perch, carp, white sucker, and long-nose sucker. Small populations of mountain whitefish, walleye, and cutthroat trout are also present in the reservoir.

The sport fishery in Hauser Reservoir is supplemented by annually stocking 200,000, 5-inch rainbow trout after spring runoff or when discharge from Canyon Ferry Dam drops to less than 7,000 CFS. These trout begin entering the angler's creel in late fall and winter as 9 to 11 inch fish and comprise the bulk of the fishery the following summer as 12 to 15 inch fish.

All species of fish found in Hauser Reservoir complete all or a portion of their life history in the reservoir or associated tributary streams. The salmonids (rainbow, brown, and cutthroat trout, mountain whitefish, and kokanee) all require moving water for successful spawning. They spawn in gravels in the tailrace of Canyon Ferry Dam, or migrate into tributary streams. Rainbow trout spawning runs occur in the spring in Trout Creek and Tenmile Creek. Brown trout spawning runs occur in the fall in Trout Creek, Spokane Creek, and lower Big Prickly Pear Creek. Kokanee spawning occurs mainly in the tailrace area in the fall but some spawning also occurs in Silver Creek. The few cutthroat trout found in Hauser Reservoir are primarily transients that have drifted into the lake from Silver Creek or from tributaries in the Tenmile Creek drainage.

Walleye spawn in the spring over gravel-rubble substrate along shallow shoreline areas. These areas are very limited because most of the shoreline of Hauser Reservoir is steep or contains unsuitable substrate. Yellow perch spawning occurs in early spring in aquatic vegetated areas or on submerged debris within the reservoir.

Newly hatched fry of all species require plankton as first food. Salmonid fry feed on these microscopic plants and animals till they are large enough to supplement their diets with insects or other small fish. Plankton remains are an important food item throughout the life of rainbow trout and kokanee in Hauser Reservoir. Brown trout also feed on plankton but greatly supplement their diet with fish as they grow larger. Yellow perch and walleye feed on plankton and also supplement their diet with insects and small fish as they grow larger. Walleye become

very cannibalistic and may utilize any species of fish readily available to them.

Fishing pressure is relatively high on Hauser Reservoir with about 42,500 angler days expended during the 1982-83 fishing season. Natural reproduction of sport and game fish is not great enough to provide good fishing under existing pressure. Therefore, the game fish population is supplemented by annually stocking rainbow trout.

Approximately another 7,000 angler days are spent on the short flowing section of the Missouri River below Canyon Ferry Dam. Sport fish catches in this segment are the same species as found in Hauser Lake.

Composition of angler catches reveal rainbow trout contribute the bulk of the fish harvested, followed in order by lesser numbers of yellow perch, brown trout, kokanee and walleye. The sizes of rainbow trout creeled vary from 8 to 20 inches with an average of about 13 inches. Brown trout are not commonly caught, but trophy specimens from 5 to 15 pounds are occasionally taken. Kokanee have increased in the reservoir the past few years and are not uncommon in anglers' creels. They range from 12 to 18 inches in length. Good catches of 6 to 8 inch yellow perch are frequently taken by both summer and winter anglers. Occasional walleye up to 3 or 4 pounds are taken.

Lake Helena, separated from Hauser Reservoir by a causeway and a short bridge, covers an area of 2,100 acres and has an average depth of 5 feet. Some trout and kokanee move through Lake Helena to spawn in tributary streams entering the west end of the lake. Water temperatures warm rapidly in this shallow impoundment in the spring (May and June) and attract thousands of spawning carp from Hauser Reservoir. A commercial fisherman occasionally harvests 40 to 50 tons of carp from Lake Helena in the fall.

The causeway area is a popular fishing spot in the winter. Anglers fish through the ice on both sides of the causeway, primarily for trout and perch. Approximately 3,200 angler days were estimated on Lake Helena in 1982-83, with most occurring during the winter months.

Recommendations: Stable shoreline with steady inflow and outflow from the Hauser system would provide optimum conditions for fishery resources. However, the spring runoff event precludes the possibility of steady flow through the system. Occasional maintenance of hydropower structures also causes some shoreline fluctuation. To avoid problems with aquatic resources and recreational opportunity, the following recommendations should be followed:

1. After spring runoff, no late season spills should be released from Canyon Ferry Reservoir. We stock Hauser

Reservoir after spring runoff to lessen fish movement over the dam.

2. Fall flow should be stable to accommodate spawning conditions for brown trout and kokanee in the Canyon Ferry tailrace.

3. Hydro-structure maintenance drawdowns should be accomplished during non-holiday periods in August and September. A flow of at least 4,100 CFS should be maintained below Canyon Ferry and Hauser dams. Headboards should be installed under the causeway bridge to maintain water elevations in Lake Helena during drawdown.

4. Winter water levels in Hauser Reservoir should be steady to prevent ice fracture, thereby lessening the danger to ice-based recreation opportunity.

Wildlife

Lake Helena empties into the Lake Helena area of Hauser Reservoir through a narrow outlet at the causeway. During periods of stable Hauser reservoir elevations, Lake Helena is at the same elevation as Hauser. The causeway outlet is quite narrow. Consequently, during rapid water level fluctuations in Hauser, a gradient develops at the outlet of Lake Helena and water flows into or out of Lake Helena at a rapid rate.

Lake Helena is an important waterfowl area. The upper end is used for nesting by Canada Geese and ducks and is used for brood rearing as well. The area is a popular waterfowl hunting spot. Waterfowl utilize Lake Helena as a resting area during their fall migration.

The potential for increasing waterfowl production on Lake Helena is high. Production is currently limited by a scarcity of suitable nest sites. Increasing the number of nesting sites on the lake would dramatically increase waterfowl production.

Water level fluctuations in Hauser that affect Lake Helena levels are of particular concern during the waterfowl nesting season. Waterfowl can suffer serious losses during the nesting season if water levels are lowered to the point where predators gain access to the nest sites.

Recommendations:

1. There should be no water level fluctuations in Hauser which would affect Lake Helena during the waterfowl nesting season.

2. Water level fluctuations in Lake Helena due to maintenance related drawdowns of Hauser Reservoir during the waterfowl nesting season should be minimized by placement of boards in

the causeway structure. Response to water level fluctuations in Lake Helena at other times of the year should be coordinated with the Helena Valley Irrigation District.

Recreation

The normal year round elevation is approximately 3,635 ft.

Hauser is operated as a run-of-river reservoir and therefore this area experiences a fairly constant water elevation. Development along the lake shore has occurred and is dependent upon this relatively constant water level. Fluctuations in Hauser Lake could have a significant impact upon many developments surrounding the lake due to the small gradients on several of the developed shorelines. The developed recreation resources at Hauser Lake were evaluated on a site-by-site basis.

Riverside. Located at the base of Canyon Ferry Dam, this site is occasionally impacted by releases from Canyon Ferry Dam.

The resources present at this site include 1 boat ramp, 20 camp sites, and 5 day use parking lots. The boat ramp becomes non-functional at high water levels. Five of the campsites and one day use parking lot were flooded during high water in 1984.

The 1983 visitation totaled 38,500, which was measured by traffic counter. Fisherman and day use account for almost 2/3 of use in this area. The boat ramp is used by approximately 1/2 of the visitors.

Effect of water levels: As mentioned previously, this area is unable to tolerate high water levels. River flows of more than 18,500 cubic feet per second from the Canyon Ferry Dam begin to flood the area. Low water levels are acceptable and would cause little damage.

Optimum water levels: The optimum elevation is 3,635.20 feet. Discharge levels from Canyon Ferry Dam are measured in cubic feet per second. These are also given. The acceptable range of discharge from Canyon Ferry is 3,500 CFS-18,000 CFS, and optimum discharge level is approximately 5,500 CFS.

Lakeside. There is considerable recreational development, both commercial and private on Hauser Reservoir in the vicinity of Lakeside. Many private docks are found along the shoreline and a commercial marina is located at Lakeside. This area is very popular for summer water-based recreation. In addition, many permanent homesites are located along the shoreline.

Reservoir fluctuations associated with past power peaking tests indicated that daily water level fluctuations over 1.0 feet in magnitude seriously impact the boating facilities in this area.

Optimum water conditions for this area are stable water elevations at elevation 3,635.2 ft.

Causeway. The resources present at this site include one unpaved boat access for small boat use, and parking spaces for day use and fishing. This area is located at the man-made causeway connecting Hauser Lake and Lake Helena. It is on a shallow, narrow bay which has a number of private homes surrounding it. Some of these homes are on the same elevation as the recreation site.

This area and the adjoining causeway receive high use by fishermen. The visitation for 1983 totaled 1,200 which was measured by traffic counter. All of the use at this area is day use and fishing. The area receives heavy use during the winter months.

Effect of water levels: The developed area could not tolerate water levels that would be higher than average. As it currently exists, there is very little bank area.

Low water levels would have an effect on recreation. The bay is very shallow, and low levels would create a large mud flat in this area. Very slight fluctuations causing the water level along the shoreline to rise could be tolerated although they may cause damage to the already eroded shoreline. Any water fluctuations during the winter months would weaken ice conditions and make winter use very hazardous.

Optimum water levels: The desirable range of elevations is 3,634.7 to 3,635.7, and the optimum elevation is 3,635.20 feet.

White Sandy. This area is located on the lower portion of Hauser Lake approximately 1 1/2 miles from the Montana Power Dam.

The resources present at this site include two unpaved boat ramp lanes, three parking areas, and ten camp sites.

This area is unique as it has very good sand conditions. The banks surrounding the lake are fairly steep and easily impacted by erosion.

Visitation in 1983 was 17,300, which was measured by traffic counter. Much of the use is day use with some overnight camping and use by boaters. This area also receives heavy use during the winter.

Effect of water levels: This area may be able to tolerate a greater range of water levels than other areas around Hauser Lake due to the steep banks in this area. Low water levels would have little or no effect in this area.

Optimum water levels: The desirable range of elevations is 3,634 ft-3,637 ft, and the optimum elevation is 3,635.20 ft.

Black Sandy. This area is located on the lower portion of Hauser Lake approximately 1 mile from the Montana Power Dam. The resources present at this site include 1 paved boat ramp, 50-60 camping sites, and 3 parking areas with picnic facilities. This area is a well developed camping area complete with scenic overlooks and maintained lawns.

The visitation in 1983 was 58,200, which was measured by traffic counter. Much of the use is overnight use with some day and fishing use. The boat ramps are used heavily.

Effect of water levels: Much of this area is located on a fairly shallow gradient. High water levels would flood large portions of this site and cause the boat ramps to become non-functional. Low water levels would have little or no effect. Fluctuations during winter months would cause weakening of the ice and hazardous conditions.

Optimum water levels: The desirable range of elevations is 3,633 ft-3,636 ft, and the optimum elevation is 3,635.20 ft.

Summary of optimum water levels for all sites at Hauser Lake: Desirable range of elevations is 3,634.7 ft-3,635.7 ft, and optimum elevation is 3,635.2 ft.

Fisheries

The short, free-flowing segment of the Missouri River between Hauser Dam and Holter Lake is about 3 1/2 miles in length. This "Blue Ribbon" segment of the Missouri supports excellent populations of rainbow trout, brown trout, and mountain whitefish. Kokanee are seasonally abundant during fall spawning. Other species inhabiting the area include a few cutthroat trout, yellow perch, walleye, carp, and large numbers of white and longnose suckers.

This segment of the Missouri River is very important for brown trout and rainbow trout spawning. In fact, it presents the only significant spawning beds for brown trout that inhabit Holter Lake or live in the river year around. Holter Lake brown trout begin moving into the river in late September to spawn on gravel beds below Hauser Dam, near the mouth of Beaver Creek and in the river channel below Beaver Creek. Peak spawning occurs in October and November. Population estimates indicate between 1,000 and 1,500 brown trout over 18 inches in length are present in the area during the spawning season. Brown trout do not appear to migrate into Beaver Creek, a small tributary to the river about 2 miles below Hauser Dam. However, Beaver Creek does support a resident population of brown trout.

Rainbow trout utilize the river and Beaver Creek for spawning in the spring. A significant movement of adult rainbows move up Beaver Creek to spawn in late March and April. Many of these fish move into the area from Holter Lake.

A number of mountain whitefish inhabit the Missouri River below Hauser Dam. They complete their complete life history in the short river segment since very few are ever noted in Holter Reservoir. Whitefish spawn over gravelly areas in the fall, primarily in the first half mile of river below Hauser Dam.

Kokanee also move into the river segment below Hauser Dam to spawn in the fall. They select gravel areas similar to those utilized by brown trout. Kokanee appear to be increasing in the system.

This area of the Missouri River is a very popular fishing water. Fishing pressure estimates reveal 12,000-14,000 angler days are expended yearly in this river segment. Rainbow trout comprise the bulk of the catch, followed by nearly equal numbers of brown trout, mountain whitefish, and kokanee. A few cutthroat trout, yellow perch, and walleye are also taken. The area has special interest by those anglers seeking trophy brown trout during the fall spawning season. Brown trout 5 to 12 pounds are frequently taken.

Most of the rainbow trout caught in this river are of hatchery origin. Although the river is not stocked, they move into the area from Holter Reservoir or flush over Hauser Dam. Rainbow trout caught by anglers vary from 8 to 24 inches. Early spring fishing is enhanced by spawning rainbow trout moving into the area from Holter Reservoir. A few trophy rainbows in the 3 to 5 pound range are taken.

Recommendations: The Missouri River below Hauser Dam is an important brown trout spawning area. It receives very heavy fishing pressure nearly year around. In order to provide suitable spawning and rearing conditions for brown trout and recreational opportunity, the following recommendations should be followed:

1. Fall and winter flow should be steady and a minimum of 4,100 CFS. This would insure spawning and hatching conditions for brown trout and kokanee.

2. If hydro-structure maintenance calls for partial dewatering of the Hauser tailrace area, it should be done from late July through early October during non-holiday periods.

Recreation

The river between Hauser Dam and Upper Holter reservoirs receives recreational use by floaters and hikers; however, the predominant recreation activity is fishing. The 3 1/2 miles of river below Hauser Dam contain excellent trout populations and offer an outstanding trophy brown trout fishery. It is rated as a Class I stream.

Discharge patterns which would damage the fishery resource or impact the fishability would affect the largest segment of recreational use in that reach of water. Flows necessary to maintain that fishery are addressed in the Fishery discussion.

Flows which are either too high or too low can impact floating. Low flows uncover obstacles and rocks which can become hazardous. This applies to approximately the upper 1 1/2 miles where stream gradients are relatively high. High flows also cause safety problems for floaters. The point at which flows become a problem, however, has not been identified.

Holter Reservoir

Fisheries

Holter Reservoir is about 25 miles in length, has a surface area of 4,800 acres, and contains about 240,000 acre feet of water. Shoreline features of this reservoir are similar to that of Hauser Reservoir, i.e. steep high banks, sharp dropoff and stable water levels.

Species of fish present in Holter Reservoir are the same as found in Hauser Reservoir, and their life histories are similar. Spawning facilities are inadequate to maintain a sport fishery as demanded by the fishing public. Salmonid spawning habitat to the reservoir proper is limited to two small tributaries, Cottonwood and Willow creeks. Spawning waters are also available in the Missouri River and Beaver Creek, which were discussed previously.

The sport fishery in Holter Reservoir is now supplemented by stocking 325,000, 5-inch rainbow trout yearly. The fish are stocked after spring runoff drops to 7,000 CFS spill from Holter Dam. The trout grow rapidly to about 10-11 inches in length by November and to 15-18 inches by the end of the following summer. Fishing pressure estimates reveal about 94,000 angler days are expended yearly in Holter Reservoir.

Spring flood spills at times cause severe losses of fish over Holter Dam. Duration and magnitude of the spill both have a factor in determining fish loss. Such occasions occurred in 1975, 1976, and 1981. In 1975, a spill of over 10,000 CFS occurred for 43 days of which 13 days exceeded 20,000 CFS. In 1976, a spill over 10,000 CFS occurred for 79 days of which 13 days exceeded 15,000 CFS. Then again in 1981, a spill over 10,000 CFS occurred for 36 days of which 20 days exceeded 20,000 CFS. Considerable fish loss again occurred in 1984 but flow figures are not yet available.

Recommendations: Flood spills greatly affect the sport fishery in Holter reservoir. Excessive spills should be avoided whenever possible.

If power plant or dam maintenance calls for a drawdown of Holter Lake, it should be accomplished in April or September after Labor Day. Flows should not be altered beyond those recommended in the Missouri below to accomodate evacuation or refilling of the reservoir.

Recreation

The normal summer elevation is 3,580 feet.

This reservoir is located approximately 4 1/2 miles downriver from Hauser Dam. Much of the shoreline is under private ownership. The shoreline gradient ranges from steep canyon walls on the north end to flat grasslands on the southern shore.

This area receives heavy recreational use during the summer months. A privately owned visitor center is maintained, and boat tours of the river between Upper Holter Lake and the Gates of the Mountains are conducted during the summer months. Also maintained in this area are 120 privately owned boat docks.

The US Forest Service maintains two campgrounds downriver from the lake. These receive heavy use by floaters and boaters on the river. Although the State of Montana maintains no recreation areas here, a brief evaluation was done at Upper Holter and the campgrounds along the river.

Upper Holter Reservoir--Gates of the Mountains Boat Club and Tours. The resources present at this site include 1 paved boat ramp, 1 privately owned visitor center, 120 privately owned boat docks, and mooring facilities for 2 large tour boats.

This area receives high boating use. Fishing and cruising are primary boating activities. The visitor center and boat tours attract a large number of tourists to the area.

The actual numbers of visitors in the area are not maintained. Number of people using the boat tours in 1984 was 27,000.

Effect of water levels: High water levels would tend to cause flooding in this area. There would also be problems with the boat ramp and mooring facilities. Low water levels create problems with mud flats appearing near the shoreline. This will affect the boating use on the lake. Drops in the water level will also have an effect on the actual boat tours. The large tour boats would be unable to get to the mooring area or to let tourists off at the stopping place on the river during the tour.

Optimum water levels: The desirable range of elevations is 3,579 feet-3,581 feet. The optimum elevation is 3,580.

Meriwether Campground (FS). The resources present at this site include one permanent boat dock, picnic facilities, shelter, and camping facilities.

This campground is located on the side of the river which creates the border to the Gates of the Mountains Wilderness. It receives heavy use by boaters and backcountry hikers. It is the campground that is utilized by the Boat Tours as a mid-tour stopping place. The permanent dock facility is designed for this purpose.

Effect of water levels: High water levels may cause flooding of the area. The permanent mooring facility would become

nonfunctional. Low water levels would cause the mooring facility to be too far out of the water to be functional.

Recommended water levels: The desirable range of elevations is 1 foot above and 1 foot below the normal operating elevation. The optimum elevation is the normal operating elevation.

Coulter Campground (FS). Resources present at this site include undeveloped boat mooring, camping facilities, and picnicking facilities.

This campground is located on the side of the river which creates the border to the Gates of the Mountains Wilderness. Like Meriwether campground, it receives use by boaters and backcountry hikers. It is less developed than Meriwether.

Effect of water levels: High water levels may cause flooding in this area. The high water may make the beach and mooring area to be nonfunctional. Low water levels would create a larger beach area but would also make boating in the area hazardous.

Recommended water levels: The desirable range of elevations is 1 foot above and 1 foot below the normal operating elevation, and the optimum elevation is the normal operating elevation.

Holter Lake

Recreation

The normal summer elevation of Holter Lake is 3,578 feet. This lake was created by the second of two Montana Power Dams on this section of the Missouri River. It is located approximately 22 miles downstream from Upper Holter Lake.

The area surrounding this lake receives heavy recreational use during the summer months. There are four campgrounds along its east shore. The southern end borders on the Beartooth Game Management Area and receives heavy hunting and fishing use.

There are many privately owned cabins along the east shore. A privately owned marina and lodge are also present. The largest campground on Holter Lake is maintained by the Bureau of Land Management and is included in this report.

The following four recreation sites were evaluated: Holter Lake (BLM), Juniper Bay (SRA), Log Gulch (SRA), and Departure Point (SRA).

Holter Lake (BLM). This campground is located at the north end of the lake. It is a well developed and maintained campground that receives heavy use during the summer months.

The resources present at this site include 1 large paved boat ramp, 1 permanent boat dock, approximately 60 camping sites, and paved parking areas for picnic and day use.

This area appears to be well maintained. It is a paved and highly developed camping area.

The Bureau of Land Management recorded 398,808 visitor hours spent in this campground in 1983.

Effect of Water levels: This area is located fairly high above the high water mark in the lake. It appears that high water levels would cause little or no problems with recreational use in the area. Low water levels could be tolerated within limits. There may be problems with the boat ramp coming out of the water if the water levels drop too low.

Recommended water levels: The desirable range of elevations is 3,576 feet-3,580 feet, and the optimum elevation is 3,578 feet.

Juniper Bay (SRA). This area is located on the east shore of Holter Lake. It is approximately 4 miles from the BLM campground.

The resources present at this site are two parking lots for camping and picnicking use and a large beach area. The presence of the beach area makes this an ideal area for swimming and picnicking. The area also receives fairly heavy fishing use.

Visitation for 1984 was 61,536. This figure represents visitation at Log Gulch, Departure Point, Juniper Bay, and the Beartooth Game Range.

Effects of water levels: Due to the location of this area, high water levels would not be tolerated. They would rapidly flood the beach area and the picnic area that is located close to the water. Low water levels would create a larger beach area and may cause problems with boat use.

Recommended water level: The desirable range of elevations is 3,576 feet-3,578.5 feet, and the optimum elevation is 3,578 feet.

Log Gulch. The resources present at this site include 1 paved boat ramp, one unloading and loading courtesy dock, 2 large parking lots for boat trailers, and 50-60 camping sites.

This area is located approximately 1 mile further around the east shore of the lake from Juniper Bay. It is a large campground that is designed for the use of boats. A portion of the property is leased from the Montana Power Company.

Visitation for 1984 was 61,536 vehicles. This figure represents visitation at Log Gulch, Departure Point, Juniper Bay, and the Beartooth Game Range, and was measured by traffic counter.

Effects of water levels: This area is located away from the lake shore itself. High water levels would create some problems with the dock. Low water levels would cause problems with both the boat ramp and dock, and use of the campground would drop.

Recommended water levels: The desirable range of elevations is 3,577 feet-3,579 feet, and optimum elevation is 3,578 feet.

Departure Point. The resources present at this site include (camping), and (day use parking), and beach area.

This area is located approximately 1/2 mile further down the east shore from Log Gulch. The parking area is used for camping. The area has a fairly large beach area that receives heavy use from fishing and picnicking.

Visitation for 1984 was 61,536 vehicles, which was measured by traffic counter. This figure represents visitation at Log Gulch, Departure Point, Juniper Bay, and the Beartooth Game Range.

Effect of water levels: High water levels would create problems in this area as the beach would become flooded very rapidly. This would most likely reduce use levels here because most users

come to the area for the beach. Low water levels would increase the amount of beach available and would have little effect on recreation in the area. Fishing would become somewhat more difficult.

Recommended water levels: The desirable range of elevations is 3,577 feet-3,579 feet, and the optimum elevation is 3,578 feet.

Summary of Recommended Water Levels for All Sites on Holter Lake. The desirable range of elevations is 3,577 feet-3,578.5 feet, and the optimum elevation is 3,578 feet.

Missouri River--Holter Dam to Great Falls

The Missouri River from Holter Dam to Great Falls is a popular and heavily utilized recreation area. Activities include fishing, floating, boating, picnicking, camping, and hunting. The river contains excellent trout populations and is classified as a Class I stream from Holter Dam downstream to Sheep Creek. Below Sheep Creek, it is a Class II stream. Deer and pheasants occupy the riparian zone, and the river experiences seasonal use by waterfowl. Fishing is by far the dominant recreational activity in this reach.

Fisheries

This free-flowing reach of the Missouri River is about 88 miles in length. Stream gradient averages only about 2 feet/mile and varies from 7.84 feet/mile at Halfbreed Rapids to 0.52 feet/mile near Ulm. The principal tributaries entering the Missouri River in this reach are the Dearborn, Smith, and Sun rivers; Little Prickly Pear, Sheep, Rock, Stickney, Hardy, and Wegner creeks. The tributaries add considerable flow to the Missouri during spring runoff, but they contribute very little flow during the remainder of the year.

Present day flow regimens of the Missouri River are not entirely natural because of regulation and storage at several dams in the drainage upstream from the study area. Flow is largely controlled by Canyon Ferry Reservoir, the largest of three consecutive upstream reservoirs. Canyon Ferry was completed in 1953, and is operated by the US Bureau of Reclamation for irrigation, hydropower, flood control, recreation, and supplemental water supply for the city of Helena. Hauser and Holter reservoirs lie downstream of Canyon Ferry Dam and provide head for power generation. Hauser and Holter dams are owned and operated by Montana Power Company.

The 61.5 mile reach of the Missouri River from Holter Dam to the confluence of the Smith River is classified by the Montana Fish and Game Commission as a blue ribbon trout fishery (Brown et al. 1959). This is one of the longest single reaches of blue ribbon trout stream in Montana, and it represents 14 percent of the state's original 452 miles of blue ribbon water. An excellent fishery exists in this area for trophy-sized rainbow and brown trout. Many trout from 5 to 10 pounds are taken by anglers each year as well as a good number of trout larger than 10 pounds. Fish larger than 10 pounds are predominately brown trout. Mountain whitefish are several times more abundant than trout and provide an important winter fishery. A few burbot and walleye are found in the river; however, they are not nearly as abundant as trout and whitefish. Longnose and white suckers, carp, longnose dace, and mottled sculpin are the prevalent nongame species.

The 27 mile reach from the mouth of the Smith River to Great Falls does not contain the quality sport fishery as the upper river segment, but still offers opportunity for some excellent fishing. Access is very limited which detracts from recreational opportunity in this reach of river.

A creel survey conducted from April through October, 1980, on the sport fishery of the Missouri River indicated anglers caught 0.36 rainbow trout per man-hour (trout/hr) and 0.02 brown trout/hr (Berg 1981 b). The catch rate ranged from a low of 0.21 trout/hr during the runoff peak in June to a high of 0.77 trout/hr in August. Boat fishermen caught 0.90 trout/hr while bank fishermen caught 0.31 trout/hr. Other fish species taken in the creel in 1980 included mountain whitefish, brook trout, cutthroat trout, walleye, yellow perch, burbot, longnose and white suckers, and carp. About 65 percent of the anglers interviewed in 1980 were from Great Falls, 27 percent were from other parts of Montana, and 8 percent were from out-of-state.

An estimate of statewide fishing pressure was compiled for the 1975-76 fishing season by the Montana Department of Fish and Game (MDFG 1976). Results of the survey indicated about 69,500 angler days were expended on the 61.5 mile reach of the Missouri River from Holter Dam to the confluence of the Smith River. This amounts to an average of 1,130 angler days per river mile. By comparison, fishing pressure on 102 miles of the Madison River averaged 957 angler days per river mile during the same fishing season. The Madison is regarded as one of Montana's premier trout rivers.

The best method of determining instream flow needs for fish is to derive flow recommendations based on field study of the biological requirements of key fish species. Rainbow and brown trout are the most important game fish in the Missouri River, and they comprise the bulk of the sport fishery.

Research studies conducted on the Missouri River indicate side channels around islands are vital for rearing of young-of-the-year rainbow and brown trout from early July until about mid-October. Considerably greater numbers of young trout utilize habitat associated with the side channels than in the main river channel.

Brown trout appear to prefer spawning habitat associated with side channels. This preference is apparently related to more suitable depth, velocity, substrate, and adjacent cover characteristics than offered by the main river channel.

Brown trout initiate spawning in about mid-October with peak spawning in early November. Rainbow trout spawning also occurs in side channels, in late March and early April. Based on these conditions, adequate flow must be maintained in side channels for trout spawning and egg incubation from mid-October through mid-May.

Eleven side channels of the Missouri River between Holter Dam and the confluence of the Smith River were intensively studied to evaluate the amount of flow required to maintain suitable conditions in the side channels for rainbow and brown trout spawning, incubation, and rearing. Habitat conditions (mean channel depth, water velocity, and flow) were very good, and trout utilization of side channels for spawning and rearing remained consistently high when flows were 4,000 CFS or higher in the Missouri River. However, habitat conditions and utilization of the side channels for spawning and rearing declined precipitously when flows receded below 4,000 CFS. At a flow of 4,100 CFS, 64 percent of the side channels contained adequate flow for trout spawning, incubation, and rearing, while at 3,600 CFS only 9 percent of the side channels contained adequate flow.

Recommendations: The segment of the Missouri River from Holter Dam to Great Falls is one of the most popular trout fishing rivers in Montana. It contains productive water, has good access, and high aesthetic value. It is important that aquatic habitat preservation be given high priority to maintain the excellent recreational opportunity offered on the river. To maintain this opportunity, the following flow recommendations should be met:

1. Maintain a minimum flow of 4,100 CFS for trout spawning and juvenile trout rearing from mid-October through mid-May.

2. The fall minimum flow base should be established before brown trout spawning activity commences in mid-October. If flow is dropped after brown trout spawning occurs, many redds or eggs may be exposed or located in areas unsuitable for proper incubation.

3. Maintain steady flow releases under 7,000 CFS after spring runoff recedes. Flow in the Missouri River below Holter Dam greater than 7,000 CFS simulates mini-flooding patterns, affects timing of aquatic insect hatches in August and September, and restricts optimum angler use during the peak fly fishing season.

Wildlife

There are considerable wildlife values associated with the Missouri River from Holter Dam to Great Falls. Sizable beaver and muskrat populations occur on the river. Interest in trapping is very high, especially when pelt prices are good. River otters are also present.

The ecosystem provides nesting habitat for peregrine falcons, osprey, and bald eagles. The Missouri River below Holter is a winter concentration area for bald eagles and is heavily used by bald eagles during spring and fall migration. A large great blue heron rookery is located approximately 5 miles above Cascade.

Canada goose nesting is an important consideration on the Missouri River below Great Falls. During the course of a 5 year inventory and planning study on the Missouri River, 629 Canada goose nests were located. All nests were found on islands within the river.

Maintaining adequate flows around these islands is necessary to insure that the nests are protected from mammalian predators. Under extreme low flow conditions these predators have easy access to the islands and can significantly reduce goose production. The security of the islands is a primary factor in their selection as nest sites by geese. This security is provided by adequate side channel flows which are a function of depth, width, and velocity. A study during 1980 determined that a minimum flow of 3,550 CFS, as measured at the USGS gage below Holter Dam, is necessary to maintain secure nesting sites in most of the typical nesting islands.

The Canada goose nesting season on the Missouri River extends from mid-March to the first of June with the peak in nest initiation occurring during the first week of April and the hatching peak occurring during the first week of May. Unseasonably high flows during this period can cause nest flooding. Studies were not done, however, to determine the maximum flow levels. Until such studies are accomplished, a maximum flow of 7,000 CFS is recommended.

Recommendation: For the period from March 15 to June 1, flows in the Missouri River should be stable between a minimum of 3,550 CFS and a maximum of 7,000 CFS.

Recreation

The Missouri River from Holter Dam to Great Falls is heavily used for recreation. A frontage road parallels the river and has been designated as a Recreation Road. The section downstream from Wolf Creek Bridge contains eight state and one fishing access sites. From Cascade and below to Great Falls, there are two more fishing access sites and one more state recreation area.

Almost all recreational use along the river is influenced by river flows. Eighty to ninety percent of the existing recreational use is attributed to fishing. Floating has also become a popular sport in recent years and now accounts for approximately 50 percent of the use. Floating and fishing are often combined. Picnicking, scenery viewing and camping are additional recreational uses in this area.

Since the bulk of the recreational use in this area is fishing, flows which influence fish populations and fishing success are the most important flows influencing overall recreation use. These will be discussed in greater detail in the Fisheries Section. This section discusses flows which directly influence

the functioning and desirability of various recreation areas along the river.

Wolf Creek Bridge. The resources present at this site include one paved boat ramp, day use parking lot, and an interpretive area.

This area is located at the end of the road coming from Holter Lake. It is used as a put-in point for river floaters and is a popular fishing area. The area is approximately 6 feet above the flood stage of the river.

Visitation for 1984 was 24,100 vehicles, which was measured by traffic counters.

Craig. Resources present at this site include one paved boat ramp, a parking area for day use, and a picnic area.

This area is located on the west side of the river at Craig. It is heavily used as both a take-out and put-in area for floaters. Fishing use is also high. Much of the area is located approximately 4 feet above river flood stage.

The visitation for 1984 was 17,350 which was measured by traffic counter.

Stickney Creek. The resources present at this site include one paved boat ramp, a parking area, and five camping spaces.

This area is located on the east shore of the river approximately 5 miles from Craig. It receives use by picnickers, campers, and fishermen. The area is approximately 6 feet above flood level.

The visitation in 1984 was 7,232 vehicles which was measured by traffic counter.

Spite Hill. The resources present at this site include unpaved boat access, and fishing area parking.

This area is located approximately 1 mile downstream from Stickney Creek on the east bank. Much of the area is located directly on the river shoreline. This portion could easily become flooded. The area is used primarily by fishermen and floaters.

Visitation in 1984 was 4,085 vehicles.

Dearborn. The resources present at this site include a small camping area, and a picnic area.

This area is located on a small area adjacent to a large section of private property. The river banks in this area are extremely steep and erosion appears to be a problem. Access to the river

is limited and hazardous. The area appears to primarily be used for camping and picnicking.

Visitation in 1984 was 1,190 vehicles, which was measured by traffic counter.

Mid Canon. Resources present at this site include fishing access parking.

This area is located downstream from Dearborn and is located on the east bank. It is maintained as a fishing access site with no facility development.

No use figures are available.

Mountain Palace. The resources present at this site include a parking area, picnic area, three camp sites, and river access.

This area is located on the east bank of the river downstream from Mid Canon FAS. It is designated as a day use and picnicking area. Use is primarily fishing. Some floating use is also seen.

Visitation for 1984 was 4,400 vehicles, which was measured by traffic counter.

Hardy Bridge. Resources present at this site include fishing access and a parking area.

This area is located downstream from Mountain Palace. It is used primarily as a fishing access and floating access. The main parking area is approximately 100 feet above the river. A road leads down to the river level.

Visitation in 1984 was 3,000 vehicles, which was measured by traffic counter.

Prewett Creek. Resources present at this site include a camping area with 5 camp sites, a picnic area and access to the river.

Site is located on the Recreation Road 3 miles south of the I-15 Hardy Exit. Much of the area is located directly on the river shoreline, which becomes flooded during high water. This area is very popular with picnickers, campers and fishermen.

Visitation for 1984 was 10,224 which was measured by a traffic counter.

Cascade Bridge. Resources present at this site include a graveled boat ramp, fishing area parking and access to the river.

Site is located at the edge of the Cascade townsite on secondary 330, one mile east of the I-15 Cascade exit. Much of the area is located directly on the river shoreline. This portion is easily

flooded during high water. The area is used primarily by floaters and fishermen.

It is estimated that this site receives about 1,500 vehicles per year.

Wing Dam. This site provides river access.

Site is located one mile north of Cascade on the Cascade - Ulm frontage road. Much of the area is located on the river shoreline and experiences occasional flooding during high water. This area is very popular with fishermen. Estimates of use at this site are not available.

White Bear Island. This site provides river access.

Site is located at Great Falls. Much of the area is located directly on the river shoreline and experiences occasional flooding during high water. Site has not yet been developed and estimates of use are not available.

Summary of river flows for all areas along the Missouri River between Holter Dam and Great Falls. The desirable range of river flows is 4,100 CFS-7,000 CFS, and the optimum flow was 5,400 CFS-5,800 CFS.

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